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# Comments on the Israeli National Data Center Reports SNRC3735 and SNRC3718

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Comments on the Israeli National Data Center Reports SNRC3735 and SNRC3718

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“Analysis results of the June 2006 Slovakian and Israeli NDCs Joint Seismic  
Exercise on CTBT topics” SNRC3735

Y. Ben-Horin, Z. Hirsh, S. Barazilay, N. Levi, G. Tikochinsky and Z. Shamesh

This report presented results of analysis done at the Israeli NDC and the Slovakian NDC for seven events recorded in 2006. The purpose of the exercise was to test processing and analysis procedures, specifically for events that were not identified as earthquakes by the IDC and which may be of interest to Israel.

There was very little discussion in the report on what constituted the joint work with the Slovakian NDC. In fact, it is not known if the work in Israel and in Slovakia were done in parallel and compared at the end of the exercise or if the Israeli and Slovakian NDCs worked together throughout the processing and analysis. If the work was done together, was there any benefit to this cooperation? It is not at all clear that there was any collaboration beyond the data sharing capability.

The IDC is responsible for detecting events which are then located and screened for the SSEB. SSEB events are events that are not determined conclusively to be earthquakes. Seven events from the SSEB were chosen for further processing by the Israeli and Slovakian NDC. For events that are not detected and analyzed by the IDC, what is the Israel NDC policy on these events; are they defined not to be events because they were not seen by the IDC? If the stated purpose of the NDC is to indicate possible treaty violation, then a decision will need to be made about events that are not detected by the IDC.

The NDC processing assumes that the events on the SSEB were identified correctly, that is, the events which are detected and not on the SSEB are definitely determined to be earthquakes. This determination has not been questioned by the NDC; is the NDC comfortable with the IDC making this determination? Is the SSEB sufficiently conservative that there are no concerns about a potential explosion being identified as a definite earthquake?

The NDC routinely processes data recorded on the CNF stations and the two IMS stations in Israel, however, none of the seven events selected for the exercise was declared to be an event using automatic processing. This is surprising, since the events were chosen to be at regional distances for the Israel CNF/IMS network. One conclusion may be that the automatic event detection processing is not operating optimally or another conclusion may be that the Israel CNF/IMS network is not very sensitive. The Israel NDC should consider the utility of using the existing procedures for the Israel CNF/IMS network given its performance for the exercise. Certainly other processing procedures should be considered so that its detection capability is appropriate for regional events.

In the section on location determination for the events, results from determinations by the IDC, by the Israeli NDC and the European Mediterranean Seismological Center (EMSC) are compared. Generally the EMSC and IDC locations are consistent with each other while the Israel NDC location differs a little more. It is not clear why the IDC and NDC locations are not closer assuming that the NDC has access and uses all of the IDC data as well as data from the Israel CNF/IMS networks. Acceptance of EMSC locations as the most accurate and closest to ground truth requires assuming that data from local networks are best for location determinations. This assumption is probably correct and suggests that the Israel NDC should try and get more local network data before finalizing its location estimates, either directly from the networks or through the EMSC.

The issue of including more stations in addition to the IMS so that there is fewer gaps in the azimuthal distribution of stations is important and recognized by the NDC. The report does not say whether the Israeli CNF/IMS data would add significantly to the coverage. The report also recommends using source-station specific travel time corrections, which will also help in refining location determination, although this factor is probably not as important as reducing azimuthal gaps.

The Israeli NDC should consider including data from the EMSC to help in determining locations. The data are generally from stations closer to the event than IMS stations and should result in better locations. In addition, there is the possibility that event depths can be determined with the closer data. The question of whether the data can be obtained in a timely fashion will have to be addressed as well as issues related to quality control.

Developing source-station specific travel times is a long term program which will require calibrations using ground-truth events. These results would be useful for events in regions where either the local or global network coverage is inadequate. It would be interesting to see if travel time calibrations give location results that are significantly better than results using data from every available station/network.

In addition to the IMS screening, the Israeli NDC investigated multivariate spectral ratios and also attempted pattern recognition using results from a sonogram program (plot of filtered seismogram versus frequency of filtering window). There is more calibration needed with either method. It would be interesting to see which parameter in the SSEB would be most sensitive if an explosion is found.

“Democratic People’s Republic of Korea Nuclear Explosion Test, October 9, 2006”  
SNRC3718

Y. Ben-Horin, G. Tikochinsky, Z. Shemesh, N. Levi, S. Barzilay

The Israeli National Data Center (NDC) processed the signals from the Democratic People’s Republic of Korea (DPRK) nuclear test of October 9, 2006 to test NDC operational and analysis procedures. Although the event was announced, detection, location, event characterization and yield estimation were performed.

The DPRK test was detected by the IMS and was not conclusively determined to be an earthquake by the IDC SSEB procedures. The exact location of the test was not announced by the DPRK, however, an approximate time was indicated which corresponded to a seismic event in the vicinity of the DPRK. Results from the IMS and the NEIC gave consistent location results. The Israel CNF/IMS network did not detect the event automatically; however, this was not unexpected because of the small size of the event and distance from the Israeli network.

Location analysis of the DPRK test showed the initial, automatic IDC results and the NEIC are in very good agreement with each other and with the NDC. The Israeli NDC used data from eight primary IMS stations and the IMS used fourteen stations. Later, manual analysis by the IDC using a few additional auxiliary stations and by the NDC, which used IRIS GSN stations indicate that an accurate location estimate can be made. The NDC report noted that there was very good azimuthally coverage which undoubtedly contributed to the quality of the location estimate.

Location analysis by the NDC requires obtaining data from stations so that there is an optimal azimuthal coverage. In many cases, the Israeli CNF/IMF stations would not be sufficient for the coverage and other networks would need to be used, such as the IRIS GSN. In the analysis of the DPRK event, the NDC recognized the need for more data and also recognized the potential contribution of GSN and used the data effectively. A more appropriate travel time velocity model and a better location algorithm are secondary to obtaining data from stations so that there is good azimuthal coverage.

As expected, there is great variability in computing the value of the event magnitude and the NDC report gives a good summary of the methodology as well as the areas and reasons for variability. Magnitudes are sensitive to network configuration such as locations and good azimuthal coverage is not necessarily a guarantee of a stable and accurate magnitude measure.

The Israeli NDC attempted to estimate the yield of the DPRK test by using the IMS magnitude procedures and published magnitude-yield relations. As noted by the NDC, there are numerous magnitude-yield relations and all require knowledge of the geology in the vicinity of the source. While guesses can be made, the uncertainty caused by the lack of knowledge of source geology results in yield estimates with significant

uncertainties. The NDC can attempt to assemble the source geology for various sites of potential nuclear tests, however, it would be an immense task to know the geology well enough in the various areas..

The NDC report noted that the DPRK test was could not be conclusively be identified as an earthquake. The NDC procedures are concentrated around spectral ratios. If this methodology is fruitful in screening events, then the NDC should calibrate the system for different regions and different sources.